Attachment A-4: Revised Summary Report
of the
NASA Environmental Compatibility Assessment Workshop
March 17-19, 1998

The NASA Environmental Compatibility Assessment Workshop met in Atlanta, Georgia on March 17-19, 1998 for the purpose of addressing the environmental issues facing aviation . Concern about the environmental impact of aviation has arisen as a result of the growth of aviation and the expectation of continued growth in the foreseeable future. To address these issues NASA initiated a series of workshops to assess the contribution that new technology might have on mitigating or lessening the future environmental impacts. Approximately 85 participants attended the Atlanta workshop. They were affiliated with various segments of the aviation industry, the environmental community, academia, federal government agencies and other interested parties.

The workshop opened with several presentations and panel discussions that set the stage for the group deliberations and helped to define and bound the problems of interest. Following the opening session the participants divided into Breakout Groups that discussed the key Technical and Framework issues associated with aircraft Noise and Emissions. To initiate the workshop discussions four questions were presented to the participants:

1) What are the impacts of aviation noise and emissions on the environment?
2) How do you believe these may affect the growth of aviation?
3) Must the growth of aviation lead to increased environmental impacts?
4) What is the relationship of the NASA noise and emissions goals to aviation's impact on the environment?

While these questions were used to stimulate the discussions, they were not intended to be answered as the first order of business of the workshop. They served as signposts to indicate the general focus of the workshop efforts. At the concluding session of the Workshop the Breakout Group leaders reported on their findings and conclusions at a Plenary Session. These are summarized in the sections below.

Noise Breakout Group:

The Noise Breakout Group provided a list of major issues that needed to be addressed; these included—1) A clear definition of the noise goals (as presented in the NASA Administrator's "Three Pillars" plan; 2) Metrics to provide targets and measure performance; 3) Certification and Regulation; 4) Strategies to achieve the goals; 5) Implementation Issues, and 6) Costs and Benefits. Metrics was an important issue for the group. It highlighted the disconnect between technical measurement associated with technology development and performance from the perspective of the scientist and engineer as opposed to noise levels deemed acceptable to the public that may be influenced by variables, such as weather conditions, time of day, cumulative noise effects and personal sensitivities. In addition, the choices made for the appropriate noise metrics are critical in evaluating the community impact of the "Three Pillars Goals" as well as Certification and Regulation criteria and the establishment of technology development plan.

The Noise Breakout Group identified a number of strategies to reduce of aircraft noise levels and achieve public acceptance. These included a number of different approaches, such as research and development in unconventional airframes and engines, source noise reduction, and fixed and adaptable designs. It was noted by Boeing engineers that noise is currently a key parameter in aircraft design. The group also called for a balance between Base and Focus programs and attention to low frequency noise and vibration problems. The Group also

identified a number of areas where systems approaches and operational changes might lead to noise reductions (ATM to include noise considerations, flight operations, taxi and ground procedures). In addition the Group acknowledged that while there were some similarities, the problems of helicopter noise were different in many respects (quality, frequency, and flight paths) from that of standard fixed wing aircraft.

In discussing implementation Issues for NASA technologies, the Group identified a number of issue areas, such as the retrofitability of solutions, time from research to implementation, aircraft and engine integration, trade-off between noise and other performance criteria, and the ability to develop noise reduction technologies capable of being produced.

The Noise Breakout Group also identified a number of broad "overarching" issues. These included the observation that trends in population growth and aviation growth had the potential to exacerbate the noise problem. The questions of who should pay for reducing noise levels and how should that be accomplished were raised? There was some discussion on the role of public education, the methods of public response, and a better understanding of public acceptance and how it should be determined or measured. The opinion of the Group was that some research into the "soft areas surrounding the public and the effects of noise" was important.

In concluding its presentation the Noise Breakout Group identified those areas which they believed were important to concentrate on at the Second Workshop. These included--1) Step Changes versus Paradigm Shifts; 2) Technologies to achieve the NASA goals; 3) Technology Barriers, and 4) Benefits and Risks. Finally, the Group asked that information from a study of noise levels at selected airports be presented at the next workshop.

Emissions Breakout Group:

After some initial discussion of the questions presented to the workshop, the Emissions Breakout Group turned its attention to the development of a structure to organize its discussions. Three major classes of problems were identified (Ozone Depletion, Global Climate Change, and Local Air Quality). For each of these classes of problems they identified the emissions of greatest concern (such as, nitrogen oxides (NOx), Carbon dioxide (CO2), and other gasses or particulate of concern). Using this structure the Emissions Group then posed five basic questions for discussion—1) What should the high level NASA Program Objectives be? 2) What should the NASA Program focus be? 3) What should the scope, magnitude, and timing of emission reductions be? 4) What are the key technology issues? 5) What are the overarching issues and questions? The material below provides an overview of some of the recommendations of the Emissions Breakout Group.

NASA Program Objectives—Should provide technology so that aircraft do not have a significant impact on the ozone layer; develop technology to contribute to improvements in local air quality; and develop technology that ensures aviation contributes to meeting the United States climate change goals.

NASA Program Focus—Should protect the Ozone layer by focussing on NOx and Sulfur/Aerosols and performing basic research on ozone chemistry and transport and atmospheric models; should emphasize reductions of emissions (particularly in the landing and takeoff cycle (LTO)) of NOx, Volatile organic compounds (VOCs), and Carbon monoxide (CO) to improve local air quality; should reduce fossil fuel burned (as much as possible as soon as possible and feasible) and should look beyond fossil fuels to address Global Climate Change.

Scope, Magnitude, Timing of Reduction—By 2030 aviation should make some contribution to returning the ozone layer to the pre-CFC (Chloro-fluoro-carbon) state; reduce NOx by 35 percent by 2003 to improve local air quality; and reduce fossil fuel burned (as much as possible and as soon as possible) to minimize global climate change.

Key Technology Issues—For ozone protection, minimize cruise NOx and focus on better science and models; for local air quality, minimize NOx and VOCx in LTO cycle; and for Climate Change, identify the limits for conventional hydrocarbon fuels (practicable and feasible).

Overarching Issues—examine trade-off among emittants; develop system-level design tools; work on longer term solutions/technologies beyond fossil fuels; pay attention to affordability and economic feasibility; need for compatibility between new technologies and procedures with noise requirements. The group put forth the opinion that they "do not want to limit aviation growth IF we can address environmental issues. In considering this one of the participants summarized his view of the workshop in three succinct points: first, the objective is not to limit aviation growth; second, everyone must "pay some of the freight;" and third the acceptable levels of noise and emissions must be determined.

In preparation for the Second Workshop the Emissions Breakout Group asked that a number of studies and reports be provided. In addition, they asked that NASA provide some assessments of performance of the current fleet; LTO cycle emissions; change achievable for state-of-the-art low NOx combustors; emissions distribution model (to look at large levels), and a maximum achievable system study.

Details from the Breakout Group Presentations are contained as attachments to the minutes of the First Workshop on the NASA Environmental Website.